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# American Fern Journal

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Vol. 11

JULY-SEPTEMBER 1921

No. 3.

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## North American Species of *Equisetum*

### North of Mexico.<sup>1</sup>

JOHN H. SCHAFFNER.

There still appears to be some confusion as to the characteristics, names, and distribution of the North American species of *Equisetum*. The writer has been making a study of these plants for many years, in fact ever since, as a boy, he was unable to make some of his specimens fit the descriptions in the manuals in use at the time. The greatest difficulty was experienced with *E. laevigatum* A. Br. (1), since the plant supposed to be this species did not fit the key nor the description in several fundamental respects; but because there were not enough names to go around, the specimens were accommodated with the names which seemed to fit most perfectly. After many years of uncertainty about the matter, the writer examined the original material at the St. Louis Botanical Garden, from which Engelmann had sent specimens to Braun, and found that the plants agreed quite well with Braun's description. Similar specimens from Engelmann were also shown to the writer by Underwood from the collections at the New York Botanical Garden. As a result of this study, *Equisetum kansanum* (4) was described as a new species with annual, smooth stems and cones without a point.

It also became evident that A. A. Eaton's *Equisetum hiemale intermedium* (2) was identical with the earlier

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<sup>1</sup> Papers from the Department of Botany, The Ohio State University. No. 129.

[Vol. 11, no. 2 of the JOURNAL, pages 33-64, plate 1, was issued Oct. 12, 1921.]

*E. laevigatum*. In the meantime Farwell (7) does not see . to understand why the writer should take such a position. He says: "It seems rather peculiar to me that Engelmann, who supplied the material for the description and who as translator and editor of Braun's MSS, is the sponsor, in a measure, of the species, should have so misunderstood his own species as to have misapplied it and to have permitted such misapplication in our manuals without having called the attention of their authors thereto. A careful study of the original description will show that Braun's species has not been misunderstood, that his description applies to the annual-stemmed plant that has been passing under Braun's name." As to whether this latter statement is correct or not can be determined by reading Engelmann's translation of Braun (1). The species is characterized as follows:

"*Equiseta stichopora* (winter-*Equiseta*). Stomata disposed in two distinct ranges on each side of the groove; each range formed by one or more rows of stomata. (All known species in this division have hardy evergreen stems).

Homophyadica.

Ranges of stomata consisting each of one row.

7. *E. laevigatum* A. Braun.

Stems tall, erect, simple or somewhat branching;... sheaths elongated, adpressed, with a black limb, etc.

In size and manner of growth this new species is closely allied to *E. hyemale*, and the larger variety of *E. robustum*, but it is easily distinguished by its smoothness, its long green sheaths, with a narrow black limb, and its darker green color."

The description is quite accurate except that the color is usually not darker green than in *E. hiemale* and the sheaths are usually dilated above.

As to the statement that Engelmann might have called attention to any misplacement of the name *E.*

*laevigatum*, it will be remembered that, unfortunately, Engelmann had gone to his reward long before such misplacement was perpetrated by Eaton and Farwell. It was certainly not the older botanists who made the misplacement nor the present writer.

In Asa Gray's "Manual of the Botany of the Northern United States," Fifth Edition, 1868, (the first manual ever used by the writer), *E. laevigatum* Braun is traced out as follows: "Evergreen or perennial-stemmed, surviving the winter, mostly rough (the cuticle abounding in silex): fruiting in summer; spikes tipped with a rigid little point. (Stomata in regular rows, in our species on each side of the groove.) Stems tall and stout ( $1\frac{1}{2}^{\circ}$ – $4^{\circ}$  or even  $6^{\circ}$  high), simple or casually branched, evenly many-(15–40-) grooved: sheaths appressed.... Smooth or minutely roughish with minute tubercles; sheaths elongated," etc.

This is again a fairly accurate diagnosis except that the sheaths are not appressed when compared with *E. praealtum*, for example.

Practically the same treatment was given in the 6th edition of Gray's Manual, in Underwood's "Our Native Ferns," in Britton and Brown's Illustrated Flora, in Small's Flora of the Southern United States, in Piper and Beattie's Flora of Southeastern Washington and Adjacent Idaho, and by various other authors. In fact, all of these authors seem to have understood Engelmann's treatment alike, and it is, therefore, quite interesting to read Farwell's insistence on following "descriptions" when he utterly fails to do so himself.

Equisetum does not fall into two clearly defined natural groups. It is out of the question to establish a genus Hippochaete. The distinctions are not sharp enough for two sub-genera or sections since there are always transitional species. One can make a number of subsections but these are too closely allied, according to

the writer's opinion, to be established as sub-genera. None of the important characters, such as apiculate cones, evergreen stems, branching systems, distribution of stomata, and character of sheaths, give distinct segregations. As Clute stated a number of years ago in his "Fern Allies," "The manner of growth, the structure of the stem, and the method of fruiting are the same in all."

Below is given a list of North American species on a conservative basis. Varieties, fluctuations and hybrids will not be considered in the present paper. Fluctuations are to be seen everywhere but there are few varieties so called that are distinct altho many have been described. Some forms described as species may be good varieties and there are apparently several hybrids.

The writer is under obligations to William R. Maxon of the Smithsonian Institution for assistance in verifying certain references given in the list of species.

#### SECTIONS OF THE GENUS EUISETUM.

- I. Cones tipped with a rigid point; aerial stems perennial, with regular whorls of branches; stomata commonly in bands of two or more regular rows each, some with single rows of stomata.

##### EUISETA PRIMITIVA.

Mostly tropical species; none in our region.

- II. Cones tipped with a rigid point; aerial stems perennial, usually without whorls of branches except when the main stems are broken, but often much branched below the ground, at the surface, or rarely from the lower nodes above ground, commonly tufted; stomata commonly in single rows, rarely with bands of two or more rows.

##### EUISETA HIBERNA.

*E. laevigatum* A. Br., *E. praealtum* Raf., *E. hiemale* L., *E. variegatum* Schleich., *E. scirpoides* Mx.

- III. Cones without a point, rounded or merely acute at the tip; aerial stems annual in regions of frost, usually unbranched unless broken, but occasionally with whorls of short branches on the fertile ones, usually tufted and sometimes also with a rosette-like mass of branches about the base of the fertile ones; stomata in regular rows, the rows sometimes double.

##### EUISETA AMBIGUA.

*E. kansanum* Schaffn., *E. funstoni* A. A. Eat.

- IV. Cones without a point; aerial stems annual, all green, with or sometimes without whorls of branches at the nodes; stomata in regular lines or bands in the grooves.

## EQUISETA AESTIVALIA

*E. fluviatile* L., *E. palustre* L.

- V. Cones without a point; aerial stems annual, of two kinds, sterile ones much branched and green, and fertile ones yellowish or brownish in color with little or no chlorophyll before the spores are matured and either withering at the tip and developing green branches below, or withering completely after the spores are shed; stomata scattered in bands or irregular rows in the grooves or entirely absent on the internodes of the fertile shoots.

## EQUISETA HETEROPHYADICA.

*E. silvaticum* L., *E. pratense* Ehrh., *E. telmateia* Ehrh., *E. arvense* L.

PHYLETIC SYNOPSIS OF EQUISETUM, NORTH AMERICAN  
SPECIES NORTH OF MEXICO.

- I. Cones tipped with a rigid point, the termination of the floral axis; aerial stems evergreen.
- A. Sheath segments and deciduous teeth sharply differentiated; aerial stems usually tall and rigid, usually many-grooved (10-48); central cavity of the internode large.
1. Sheaths elongated, dilated above so as to appear more or less funnel-shaped, green in age, with a black or brown limb, sometimes with a dark band below; sheath segments slightly tricarinate; stems rather smoothish. *E. laevigatum*.
  2. Sheaths short, cylindrical, appressed, ash-colored or black in age, often with a black ring around the limb and a second one at the base, not dilated above except when young, but frequently split in age; stems very rough.
    - a. Ridges of the stem with one row of tubercles; sheath segments without a central groove or sometimes with a minute groove, normally tricarinate. *E. praealtum*.
    - b. Ridges of the stem with two rows of tubercles; sheath segments with a deep central groove, normally quadricarinate. *E. hiemale*.
- B. Sheath segments and teeth not sharply differentiated, the base of the teeth usually persistent, but the bristle tips deciduous; stems low and slender, tufted, usually 10-grooved or less, solid

or the central cavity only one-half to one-third the diameter of the internode.

1. Stem with central cavity, sheaths 5-10-toothed; sheath segments usually quadricarinate. *E. variegatum*.
  2. Stem solid, mostly 6-grooved; sheaths 3-toothed; sheath segments somewhat quadricarinate. *E. scirpoides*.
- II. Cones rounded at the top or merely acute, not with a rigid point; aerial stems annual, not surviving the winter in regions of frost.
- A. Aerial stems all green and essentially alike.
1. Fertile stems usually not branched above ground but sometimes developing whorls of minute branches while the cones are maturing; stems with cross bands of silex; plants of dry or ordinary wet soil.
    - a. Not with numerous branched basal sterile shoots around the fertile shoots; stems very smooth, with cross bands of silex; limb of the long green sheath dilated upward, with a narrow black band at the top, not incurved. *E. kansanum*.
    - b. With a cluster or rosette of small, branched, sterile shoots around the base of the fertile shoots; stems very rough with cross bands of silex; limb of the rather short sheath strongly incurved with age, with a narrow black band at the top; stomata often in two rows. *E. funstoni*.
  2. Fertile stems branched, usually with numerous whorls of branches; plants of wet soil or growing in the water.
    - a. Sheaths usually appressed; stem  $1\frac{1}{2}$ -3 ft. high, usually many-grooved, with a large central cavity in the internode. *E. fluviatile*.
    - b. Sheaths loose and somewhat dilated; stems  $\frac{1}{2}$ - $1\frac{1}{2}$  ft. high, slender, 5-10-grooved; central cavity rather small. *E. palustre*.
- B. Aerial stems of two kinds, the sterile shoots green and much branched, the fertile brown and at least at first with little or no chlorophyll.
1. Fertile shoots producing branches after the maturity of the spores, only the tips withering.
    - a. Branches of the sterile and fertile shoots compound, curved downwards. *E. silvaticum*.
    - b. Branches of the sterile and fertile shoots simple and straight. *E. pratense*.
  2. Fertile shoots withering after the spores are shed, rarely producing branches.

- a. Sterile stem ivory white or brownish, 2-10 ft. high, its branches several-angled, terete; fertile stem usually 1-2 ft. high, robust, the internodes usually without stomata, the sheaths including the 20-30 long teeth  $1\frac{1}{2}$ -2 in. long; cone 2-3 in. long, its axis hollow. *E. telmateia*.
- b. Sterile stem green or brownish in age, usually less than 2 ft. high, its branches sharply 3-or 4-angled; fertile stem  $\frac{1}{2}$ -1 ft. high, the internodes with stomata, the sheaths including the 7-15 teeth  $\frac{3}{4}$ - $1\frac{1}{2}$  in. long; cone 1- $1\frac{1}{2}$  in. long, its axis solid when young. *E. arvense*.

## LIST OF NORTH AMERICAN SPECIES.

1. EQUISETUM LAEVIGATUM A. Br. Am. Jour. Sci. 46: 87. 1844. Smooth Scouring-rush.

*E. hiemale intermedium* A. A. Eat.

Type locality: "On poor clayey soil, at the foot of the rocky Mississippi hills, on the banks of the river below St. Louis," Missouri.

In various situations, commonly on flood plains, along streams and rivers; rather open in its growth.

Conn., N. Y., and Ont. to B. C., south to Cal., N. Mex., Tex., La., and N. C.

2. EQUISETUM PRAEALTUM Raf. Florula Ludoviciana 13. 1817. Great Scouring-rush.

*E. robustum* A. Br. *E. affine* Engelm. *E. ferrissi* Clute.

Type locality: "Banks of the Mississippi River," Louisiana.

Mostly on moist, usually alluvial soil especially along brooks, creeks, and rivers commonly forming dense masses or sod-like stands.

Conn. and Quebec to B. C. southward nearly throughout the United States to Cal., Northern Mex., La., and N. C.

3. EQUISETUM HIEMALE L. Sp. Pl. 1062. 1753. Rough Scouring-rush.

Incl. *E. hiemale californicum* Milde.

Type locality: "Habitat in Europae sylvis, aspris, uliginosis."



In wet places and on river, creek, and lake banks.

Europe, Northern Asia, Japan, and Alaska; in N. Am. south to central Cal. and western Mont.

4. *EQUISETUM VARIEGATUM* Schleich. Cat. Pl. Helvet.

27. 1807. Variegated Scouring-rush.

*E. trachyodon* A. Br. *Hippochaete nelsoni* (A. A. Eat.) Farw.

Type locality: Switzerland.

In wet meadows, bogs, and alluvial thickets, especially in sandy places.

Circumpolar, north temperate zone and extending into the Arctic zone to beyond 80° N. lat.; Europe, through northern Asia, Alaska, Labrador, and Greenland; in N. Am. south to Conn., Ohio, Ill., Neb., Colo., and Ore.

5. *EQUISETUM SCIRPOIDES* Mx. Fl. Bor. Am. 2: 281. 1803.

Dwarf Scouring-rush.

Type locality: "Hab in vetustis sylvis Canadae."

In low fields, swamps, and moist coniferous woods.

Circumpolar, north temperate zone, extending beyond the Arctic circle; Europe, northern Asia, and Alaska to Greenland; in N. Am. south to Conn., Penn., Mich., Ill., Mont., and Wash.

6. *EQUISETUM KANSANUM* Schaffn. Ohio Nat. 13: 21.

1912. Kansas Scouring-rush.

*E. laevigatum* according to A. A. Eaton, not A. Braun.

Type locality: "Bloom township, Clay County, Kansas."

Commonly growing in clay soil on banks of ravines and on bluffs.

Mainly in the western Mississippi basin; Ohio to Mont. and B. C., south to Cal., Ariz., N. Mex., and Mo.

7. *EQUISETUM FUNSTONI* A. A. Eat. Fern Bull. 11: 10.

1903. Funston's Scouring-rush.

*E. mexicanum* of authors, not Milde.

Type locality: Southern California.

In moist to dry sandy soil, especially along streams. Santa Barbara and Inyo counties, Cal. southward, probably into Mex.

8. *EQUISETUM FLUVIATILE* L. Sp. Pl. 1062. 1753. Water Horsetail.

*E. limosum* L. *E. heleocharis* Ehrh. *E. uliginosum* Muhl.

Type locality: "Habitat in Europa ad ripas lacuum, fluviorum."

Usually in swamps and the margins of ponds and lakes in water up to two or more feet in depth.

North temperate zone; Europe and Asia, through Alaska to Labrador and Newf., south in N. Am. to Ore., Wyo., Neb., Va., and Conn.

9. *EQUISETUM PALUSTRE* L. Sp. Pl. 1061. 1753. Marsh Horsetail.

Type locality: "Habitat in Europae aquosis."

In wet places.

North temperate zone; Europe to Japan, Alaska, and Newf., south in N. Am. to Conn., N. J., Ill., Wyo., and San Mateo County, Cal.

10. *EQUISETUM SILVATICUM* L. Sp. Pl. 1061. 1753. Wood Horsetail.

Type locality: "Habitat in Europae septentrionalis pratis sylvaticis."

In moist sandy woods and thickets.

Circumpolar, north temperate zone, extending beyond the Arctic circle; Europe and northern Asia to Alaska, Labrador, and Greenland; in N. Am. south to Conn., N. Car., W. Va., Ohio, Iowa, S. Dak., and Mont.

11. *EQUISETUM PRATENSE* Ehrh. Hannov. Mag. 22: 138. 1784. Meadow Horsetail.

*E. umbrosum* Willd. *E. triquetrum* Bory. *E. drummondii* Hook.

Type locality: "Bei Stiege, in Fuerstenthum Blankenburg" "auf den Wiesen," Germany.

In sandy meadows, and alluvial soil.

North temperate zone; British Isles, Europe, Siberia, and Alaska to Nova Scotia; in N. Am. south to Conn., N. J., Iowa, and Colo.

12. *EQUISETUM TELMATEIA* Ehrh. Hannov. Mag. 287. 1783. Ivory Horsetail.

*E. maximum* Lam. *E. majus* Gars.

Type locality: Europe.

In various situations, especially in moist shady margins of woods. Europe and western Asia, western North Africa, and in N. Am. from B. C. to southern Cal.

13. *EQUISETUM ARVENSE* L. Sp. Pl. 1061. 1753. Field Horsetail.

*E. saxicola* Suksd. *E. boreale* Bong.

Type locality: "Habitat in Europae agris, pratis."

In various situations, especially in sandy soil and on railway embankments.

Circumpolar, north temperate and Arctic zones, reaching beyond the 80th parallel of north latitude; Europe, Northern Asia to the Himalaya Mts. and Japan; north Africa, south Africa; in N. Am., Alaska to Greenland, south to S. C., northern Mex., and southern Cal.

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## TAXONOMIC AND GEOGRAPHIC STUDIES IN NORTH AMERICAN FERNS.

### III. *Pellaea glabella* and its Western Segregates.

FREDERIC K. BUTTERS.

As stated recently in a note in the Fern Journal,<sup>1</sup> a further study of the western ferns allied to *Pellaea glabella* Mett. ex Kuhn has convinced me that there are two species occurring in the western states and Canada, closely allied to that well-known northeastern fern, but clearly distinguished from it, and from each other by numerous characters and by their geographical range. One of these, *Pellaea pumila* Rydb., originally described independently by Rydberg from the Black Hills of South Dakota,<sup>2</sup> and by Elias Nelson from Wyoming,<sup>3</sup> occurs along the eastern ranges of the Rocky Mountains from Alberta to Wyoming, the other, my *Pellaea Suksdorfiana*, appears to be confined to the region west of Rocky Mountains, occurring chiefly in the intermontane region, and ranging from British Columbia to

<sup>1</sup> Am. Fern Journ. 11: 39-40. 1921.

<sup>2</sup> Mem. N. Y. Bot. Garden, 1: 4. 1900.

<sup>3</sup> Fern Bull. 7: 30. 1899.